An Outbreak of an Enterovirus-like Illness at a Community Wading Pool: Implications for Public Health Inspection Programs

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Abstract: In June 1987, following an outbreak of an illness among children participating in a swim class, investigation revealed that 26 children who had swum in the outdoor wading pool were more likely to be ill than those who had not (OR 12.1, 95% CI = 2.9, 74.2). The pool chlorination system was operating improperly prior to onset of illness and chlorine levels were at or very near zero. This report emphasizes the need for operators and inspectors to give special attention to disinfection of wading pools. (*Am J Public Health* 1989; 79:889–890.)

Introduction

Several previous reports have associated outbreaks of enteroviral infections with community swimming pools.[1–4] Keswick, *et al*, surveyed municipal swimming and wading pools to detect enteroviruses and found viral contamination in 10 of 14 swimming pools and all seven wading pools sampled.[5]

On June 24, 1987, the Boulder County Health Department received several phone calls from concerned parents regarding an illness among children who had participated in a swim class offered at a local municipal pool in Longmont, Colorado, prompting an investigation.

The Longmont municipal pool complex houses an indoor 250,000 gallon Olympic-sized pool and an outdoor 20,000 gallon wading pool. Both pools are equipped with high rate sand filters and automatic feed gas chlorination disinfection systems. Pool personnel manually monitor the pool chemistry and perform manual adjustments to the chlorination system as necessary.

The Boulder County Health Department performs semi-annual inspections of the municipal swimming pools within the county. These inspections include a complete survey of the physical facility as well as on-site analysis of the pool water chemistry. In addition, water samples are drawn quarterly and tested for bacteriological contamination.

This report summarizes the results of the outbreak investigation and discusses the implications to public health pool inspection programs.

Methods

We conducted interviews with all children who had participated in the swim class to determine who had been ill; the onset and symptoms of their illness; the days each child attended the swim class; whether they had swum in the indoor main pool or the outdoor wading pool; their swimming behavior, food consumption, and use of drinking fountains; and whether they had attended other summer activities with the same children. We defined a case as a child with a reported fever greater than 101°F, and at least one of the following: malaise, headache, stomachache, nausea, or diarrhea. A re-interview was conducted with the families of those children meeting our case definition to determine the duration of illness. Telephone contacts were made to area pediatricians to consult on diagnoses and confirm symptoms of those who sought medical attention.

A complete physical and chemical pool inspection was performed, as well as bacteriological examination of the pool water for coliforms and total heterotrophic bacteria by standard methods. We obtained a copy of the daily water chemistry log which requires the recording of pH, temperature, turbidity, total alkalinity, and free chlorine levels.

Stool specimens were collected from several ill children meeting the case definition and forwarded to the Colorado Department of Health (CDH) laboratory for analysis of common enteric bacterial pathogens, and coliform density (standard: <1/100 ml). Viral studies were not available.

Results

The two-week swim class was held June 8–19. Of the 63 children who attended the class, 26 met the case definition. No one was hospitalized, and all symptoms resolved an average of 5.7 days after onset (range three to seven days).

All 63 children (100 per cent) reported swimming in the main indoor pool in conjunction with the scheduled swim class. However, the attack rate for swimmers who used the outdoor wading pool was 62 per cent compared to 12 per cent for those who did not use the wading pool (odds ratio 12.1, 95% confidence intervals (CI) = 2.9, 74.2).[6] When the other risk factors mentioned earlier were considered, no association with illness was found.

Inspection of the community pool complex on June 26 showed the main indoor pool to be operating properly. The outdoor wading pool, however, had to be closed. Violations included water quality deficiencies of extremely high turbidity, temperature of 92°F (maximum allowed 84°F), pH of <6.8 (minimum allowed 7.2), and an inoperative flow meter which prevented the calculation of pool water "turnover."

Review of the daily water chemistry log for the period June 8–19 indicated "0" free chlorine readings for five days, no readings taken for six days, and a low disinfection level of 0.1 mg/l free chlorine on one day. The lack of chlorine disinfectant was due to a faulty gas chlorination system. Pool personnel had manually chlorinated the pool; on the day of inspection the level was >3 mg/l. The pool remained closed until adequate repairs were made.

The earliest reported illnesses appeared on the last day of swim class, June 19 (Figure 1). The remaining illnesses from the primary exposure continued to appear through June 24. We estimated five to seven days as the incubation period based on the interval between first use of the wading pool and onset of illness.

Bacteriological testing of the main and wading pool water was negative for coliforms and total heterotrophic bacteria at the time of the inspection. Stool sample results

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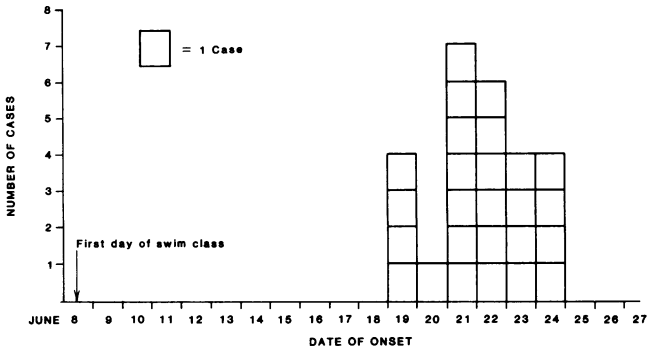

FIGURE 1—Enterovirus-like Cases by Date of Onset of Febrile Symptoms, Longmont, Colorado, June 1987

reported by the CDH laboratory were negative for *Salmonella, Shigella, Aeromonas,* and *Campylobacter* species.

Discussion

The lack of chlorination and the strong association between swimming in the wading pool and illness suggest that an infectious agent associated with the wading pool caused the outbreak. The clinical manifestations and course of the illness, estimated incubation time, potential for a fecal-oral route of transmission, and the exclusion of likely bacterial pathogens all suggest a non-polio Enterovirus as a likely etiological agent.

Wading pools are typically small and shallow, with a high surface to volume ratio. The impinging sunlight can quickly deplete chlorine as well as raise the water's temperature. Additionally, some wading pools are plumbed directly into the main pool's operating system, making it difficult to adequately control the wading pool's chemical balance. These physical factors make maintenance of proper disinfection levels and water quality an ongoing task.

Pool operators are often young and inexperienced, and our field staff has found that they tend to neglect wading pools. This is unfortunate, since by virtue of its size and clientele, the quality of wading pool water is far more likely than that of the main pool to deteriorate in a short period of time. The character of the wading pool water can change dramatically in just a few short hours of heavy use, but the change may go undetected by superficial checks. Even when a critical problem is detected, there is a reluctance by operators to close the pool until the problem is solved.

The wading pool bather load is frequently high and the associated increase in organic load quickly consumes the available free chlorine. Splashing only serves to increase the oxidation and loss of chlorine. Clearly, a large number of young children, still struggling with the complexities of proper personal hygiene, all wading around in, and drinking, waist-deep water is a textbook opportunity for a pathogen that uses the fecal-oral route of transmission.

Pool operators need to monitor and adjust chlorine levels in wading pools more frequently than in the main pool; health agencies need to inspect them more frequently, require better record keeping, establish educational opportunities for operators, and strictly enforce existing regulations. Finally, regulatory agencies must push for legislation which more appropriately addresses the operation and design criteria of wading pools.

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